Claims

What is claimed is:

1. A vacuum drainage system operable to remove waste from a source, the system comprising:

an accumulator in fluid communication with the source;

a substantially vertical riser having a first portion in fluid communication with the accumulator and a second portion downstream of the first portion and in fluid communication with a vacuum source;

a first valve disposed between the first portion and the second portion, the first valve selectively operable to provide fluid communication between the first portion and the vacuum source; and

an air inlet disposed a distance downstream of the first valve, the air inlet selectively operable to provide fluid communication between the outside atmosphere and the second portion.

2. The system of claim 1, wherein the air inlet includes a second valve.

3. The system of claim 2, further comprising an actuator operable to initiate actuation of the first valve and the second valve.

4. The system of claim 3, wherein the actuator includes a sensor portion operable to control the actuator.

5. The system of claim 4, wherein the sensor portion includes a liquid level sensor operable to measure the liquid level within the reservoir.

6. The system of claim 4, wherein the sensor portion includes a pressure sensor in fluid communication with the reservoir to sense a pressure within the reservoir.

7. The system of claim 3, wherein the actuator includes a solenoid-operated actuator.

8. The system of claim 3, wherein the actuator is pressure-actuated with a pressure within the reservoir being sufficient to actuate the actuator.

9. The system of claim 2, wherein the first valve and the second valve open and close substantially simultaneously.

10. The system of claim 2, further comprising a timer operable to delay the closure of the second valve relative to the first valve.

11. The system of claim 1, wherein the air inlet is a first air inlet, the system further comprising a second air inlet disposed within the second portion of the riser and spaced a distance downstream of the first air inlet.

12. The system of claim 11, further comprising a third air inlet disposed within the second portion of the riser and spaced a distance downstream of the second air inlet.

13. A vacuum drainage system comprising:

a source of waste;

an accumulator in fluid communication with the source and positioned below the source to receive the waste;

a vacuum source operable to provide a vacuum region;

a riser having a first portion in fluid communication with the accumulator and a second portion in fluid communication with the vacuum region;

a sensor operable to measure a waste level within the accumulator;

an air inlet operable in response to the waste level within the accumulator to provide fluid communication between the outside atmosphere and the second portion; and

a first valve disposed between the first portion and the second portion, the first valve movable between a first configuration and a second configuration,

wherein the first configuration inhibits fluid communication between the first portion and the second portion and the second configuration allows fluid communication between the first portion and the second portion.

14. The system of claim 13, wherein the vacuum region includes a collection tank.

15. The system of claim 13, wherein the air inlet includes a second valve.

16. The system of claim 15, further comprising an actuator operable to initiate actuation of the first valve and the second valve.

17. The system of claim 16, wherein the actuator includes a sensor portion operable to control the actuator.

18. The system of claim 17, wherein the sensor portion includes a liquid level sensor operable to measure the liquid level within the reservoir.

19. The system of claim 17, wherein the sensor portion includes a pressure sensor in fluid communication with the reservoir to sense a pressure within the reservoir.

20. The system of claim 16, wherein the actuator includes a solenoid-operated actuator.

21. The system of claim 16, wherein the actuator is pressure-actuated with a pressure within the reservoir being sufficient to actuate the actuator.

22. The system of claim 15, wherein the first valve and the second valve actuate substantially simultaneously.

23. The system of claim 15, further comprising a timer operable to delay the closure of the second valve relative to the first valve.

24. The system of claim 13, wherein the air inlet is a first air inlet, the system further comprising a second air inlet disposed within the second portion of the riser and spaced a distance downstream of the first air inlet.

25. The system of claim 24, further comprising a third air inlet disposed within the second portion of the riser and spaced a distance downstream of the second air inlet.

26. The system of claim 13, wherein the first valve moves to the first configuration in response to a waste level below a predetermined level and moves to the second configuration in response to a waste level above a second predetermined value.

27. A method of transferring waste using a vacuum drainage system including an accumulator that receives waste from a source and a riser having a first portion in fluid communication with the accumulator and a second portion in fluid communication with a vacuum source, the method comprising:

positioning a valve between the first portion and the second portion;

providing a selective air flow path between the atmosphere and the second portion;

sensing a waste level within the accumulator;

opening the valve when the waste level exceeds a first predetermined value; and

opening the air flow path to admit air into the second portion of the riser.

28. The method of claim 27, further comprising sensing a second waste level within the accumulator and closing the valve and the air flow path in response to the second waste level.

29. The method of claim 27, further comprising sensing a second waste level within the accumulator and closing the valve in response to the second waste level.

30. The method of claim 29, further comprising delaying the closure of the air flow path for a length of time after the closure of the valve and closing the air flow path after the closure of the valve and the passage of the length of time.

31. A vacuum drainage system comprising:

a vacuum source operable to provide a vacuum region;

an accumulator operable to receive a quantity of waste from at least one source;

a first riser portion in fluid communication with the accumulator;

a last riser portion in fluid communication with the vacuum region;

an intermediate riser portion disposed between the first riser portion and the last riser portion;

a first valve interconnecting the first riser portion and the intermediate riser portion, the first valve selectively operable to provide fluid communication between the first riser portion and the intermediate riser portion;

a first air inlet selectively operable to provide fluid communication between the outside atmosphere and the intermediate riser portion; and

a second air inlet selectively operable to provide fluid communication between the outside atmosphere and the last riser portion.

32. The vacuum drainage system of claim 31, wherein the first air inlet includes a first inlet valve and the second air inlet includes a second inlet valve.

33. The vacuum drainage system of claim 31, further comprising an air inlet valve operable to operate the first air inlet and the second air inlet.

34. The vacuum drainage system of claim 31, further comprising an actuator operable to initiate actuation of the first valve.

35. The vacuum drainage system of claim 31, further comprising a third air inlet positioned between the first and second air inlet to define a first intermediate riser portion and a second intermediate riser portion.

36. The vacuum drainage system of claim 35, wherein the first air inlet includes a first inlet valve, the second air inlet includes a second inlet valve, and the third air inlet includes a third inlet valve.

37. The vacuum drainage system of claim 36, further comprising a timer operable to delay the closure of one of the first inlet valve, the second inlet valve, and the third inlet valve relative to the other of the first inlet valve, the second inlet valve, and the third inlet valve.

38. The vacuum drainage system of claim 35, further comprising an air inlet valve operable to operate at least two of the first air inlet, the second air inlet, and the third air inlet.

39. A vacuum drainage system operable to remove waste from a source, the system comprising:

an accumulator in fluid communication with the source;

a riser having a first portion in fluid communication with the accumulator and a second portion downstream of the first portion and in fluid communication with a vacuum source;

a first valve disposed between the first portion and the second portion;

a second valve in fluid communication with the second portion;

an actuator operable to provide a pressure signal to the first valve and the second valve, the first valve and the second valve opening in response to a first pressure signal and the first valve closing in response to a second pressure signal; and

a timer operable in response to the second pressure signal to close the second valve after the passage of a predetermined length of time.

40. The system of claim 39, further comprising a first fluid path disposed between the actuator and the first valve and a second fluid path between the actuator and the second valve, and wherein a check valve and the timer are positioned within the second fluid path.

41. The system of claim 40, wherein the timer is selectively operable to inhibit fluid communication between the actuator and the second valve.